

NDOS Muon Trajectory to Decay Position

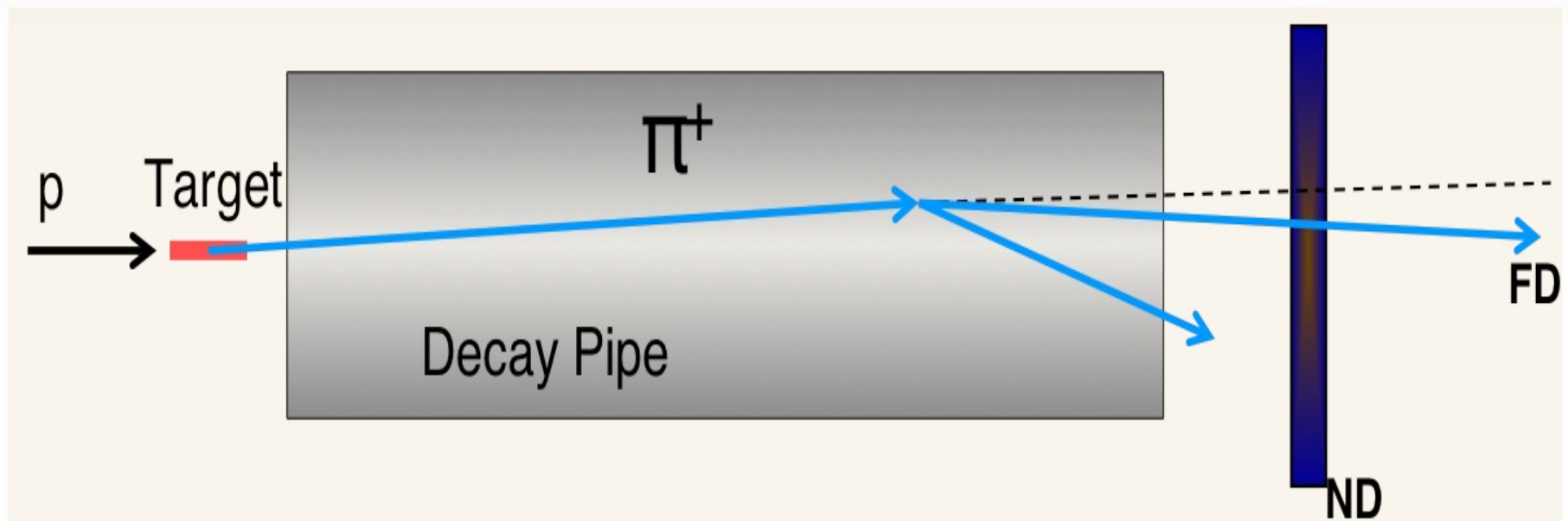
by Jeffrey Eldred
with help from Patricia Vahle

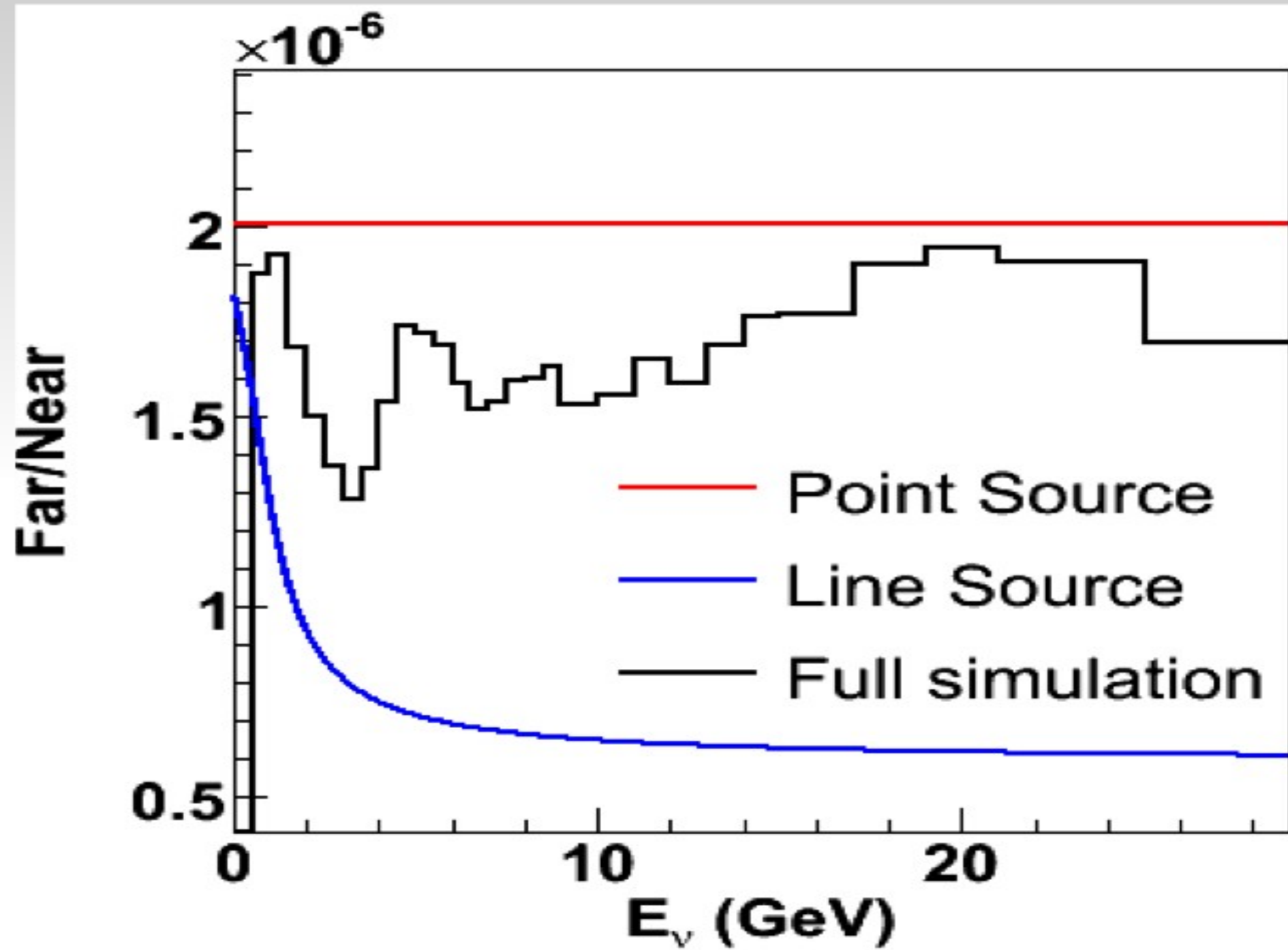
Quick Personal Update

- This presentation is part of the research I did to complete my BS from William & Mary in honors physics and applied mathematics.
- In the Fall, I will go to Indiana University for my physics Ph.D.

Neutrino energy depends on angle and decay position

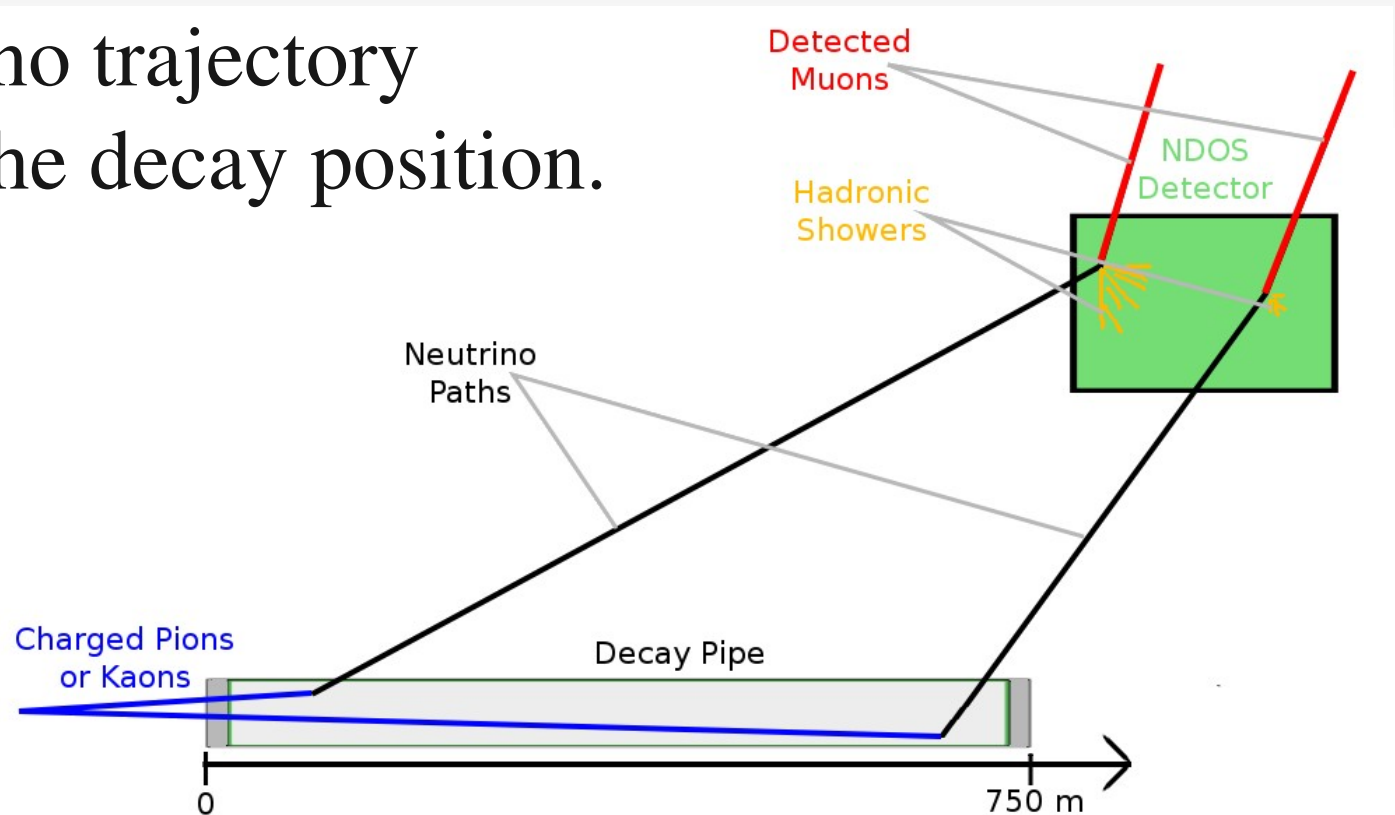
$$E_\nu = \frac{(1 - (m_\mu/m_{(\pi,K)})^2)E_{(\pi,K)}}{1 + \gamma^2\theta^2}$$

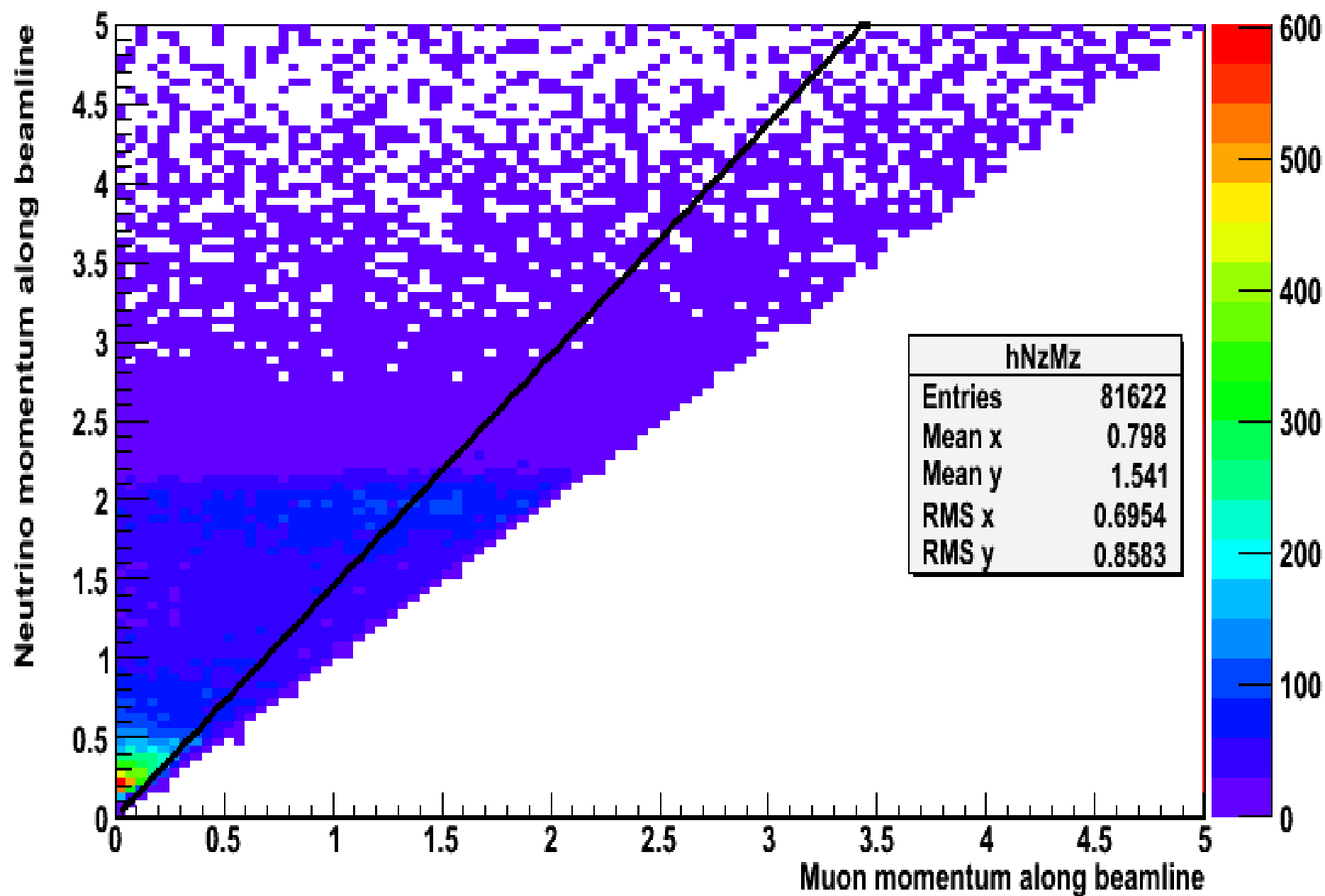


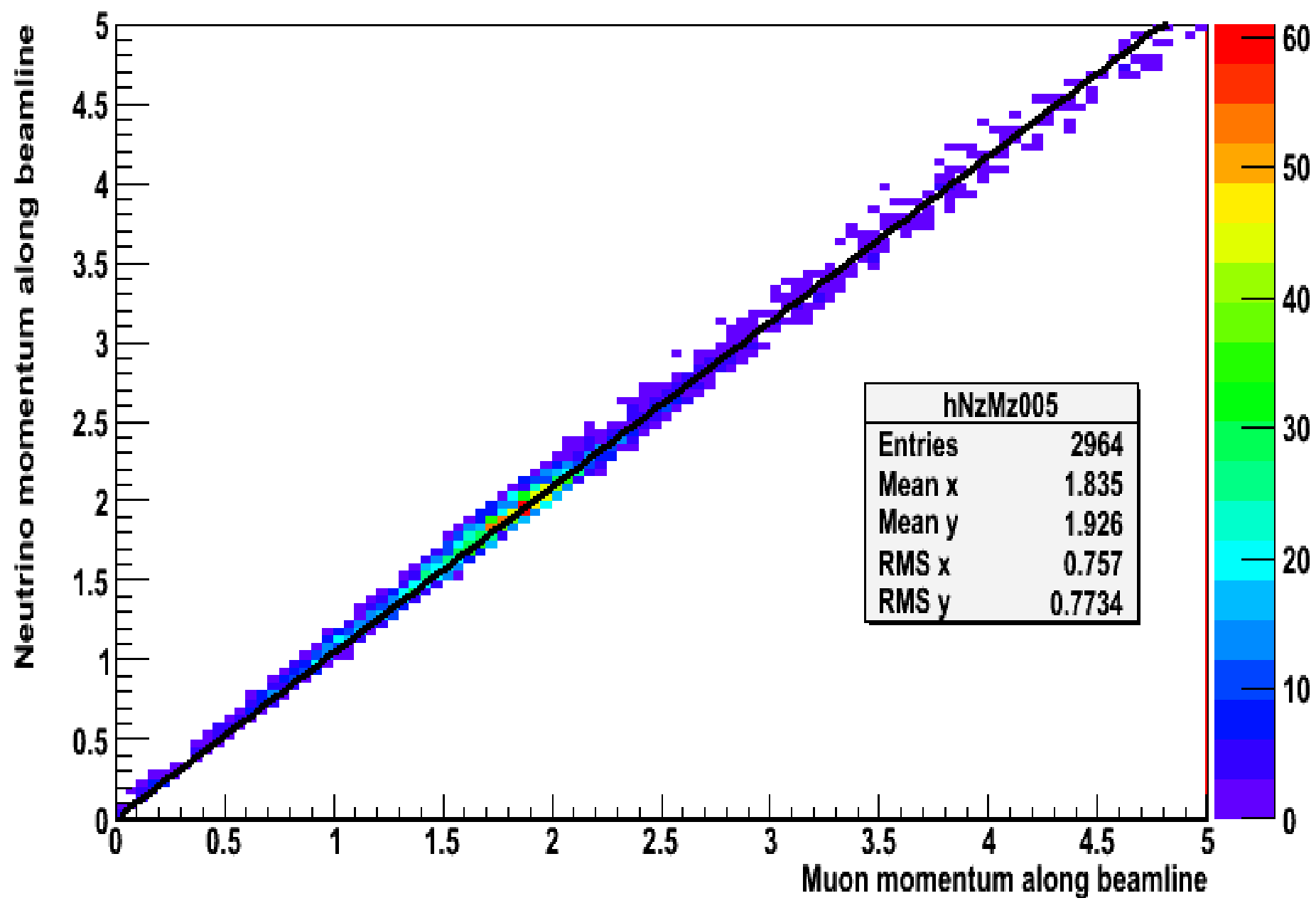


Determining decay position from detector data

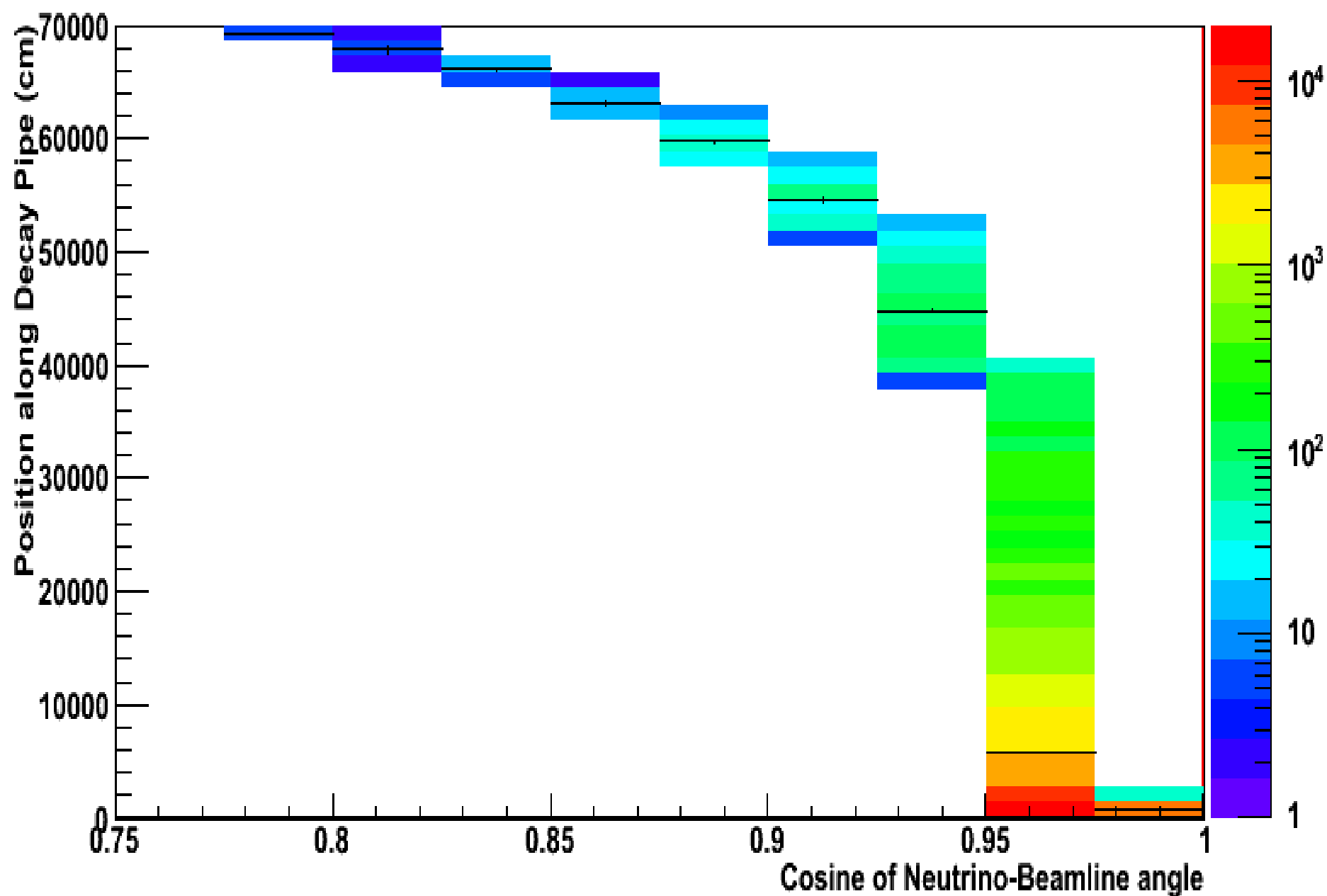
- The trajectory of muons is correlated to the trajectory of the neutrino - the smaller the hadronic shower the better the correlation.
- The neutrino trajectory reveals the decay position.



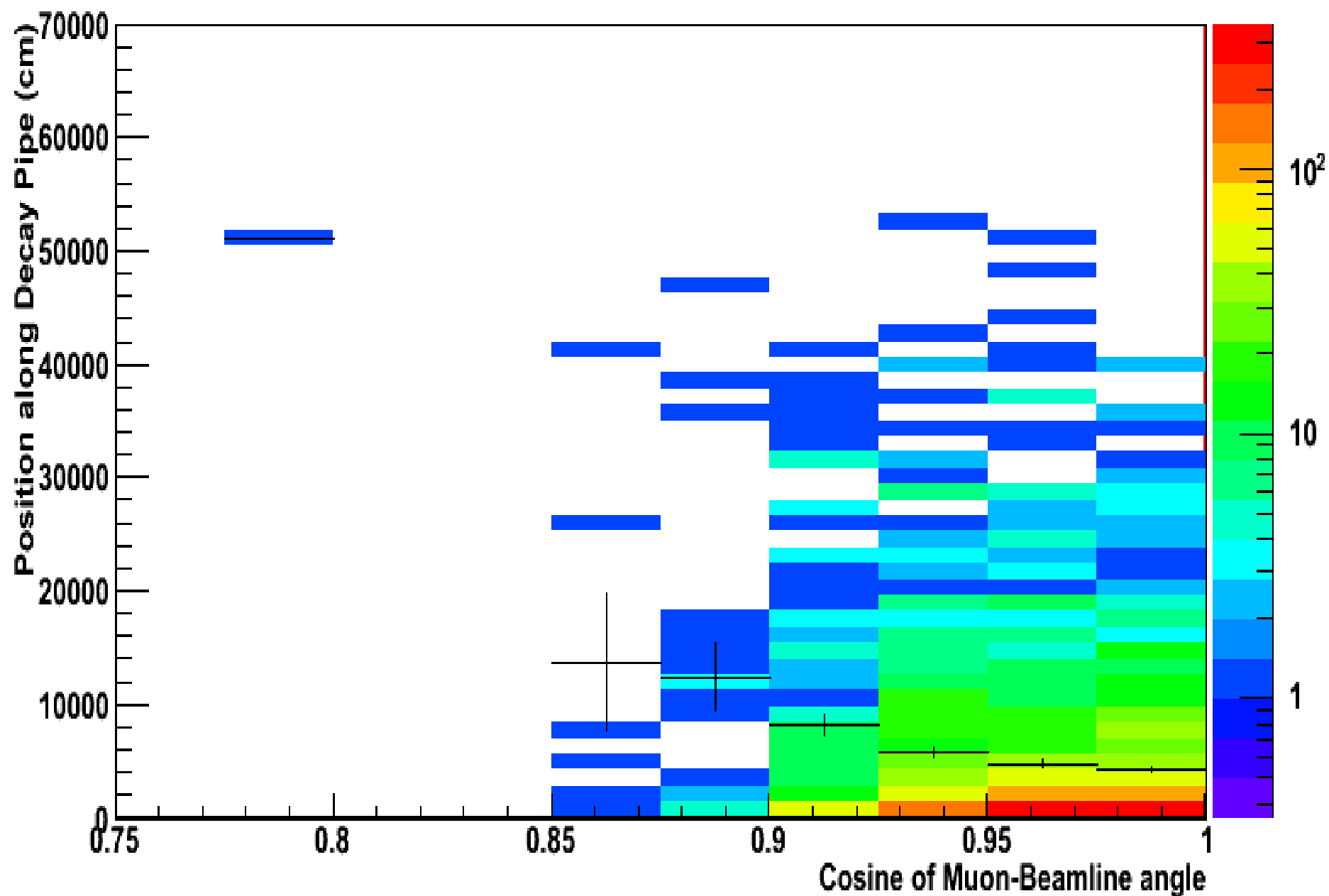




Correlation between Decay Position and Neutrino Angle



Correlation between Decay Position and Muon Angle, for $y < 0.05$ neutrino events



Conclusions with Caveats

- This shows an analysis of decay positions from muon trajectories *may be possible*.
- Uncertainty involved in reconstructing CC events and muon tracks were not included in our analysis
 - Rock muons are not included in our analysis.
- We get this signal with ~60,000 CC events.

Future Work

- Incorporate error bars from reconstruction efforts into this analysis.
- Tune parameters of the NuMI model so that there is a best fit with the distribution of muon angles that we detect in NDOS.
- Ensure that this fitting/tuning does not override more reliable data, by incorporating it into other efforts to tune the NuMI model from data.

Thank You for Listening!

***Any
Questions?***



Image sources from Brian Rebel, Zarko Pavlovic, and Mark Dorman